BOYNE RIVER

A Johnson

ONTARIO WATER RESOURCES COMMISSION

THE

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BIOLOGICAL SURVEY

of

RANKIN LAKE

1967

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SUMMARY AND CONCLUSIONS

A biological survey of Rankin Lake provided no evidence that discharge from a sewage lagoon located at Camp Wakana was affecting the lake. The practice of not allowing any discharge from this lagoon during the summer months should be continued. Since any malfunction of the treatment system presents a potential hazard for Rankin Lake, regular inspection of the lagoon should be continued.

The number of cottages on the lake, many of which utilize septic field systems for sewage disposal, necessitates regular sampling for bacterial contamination. Particular emphasis should be placed on securing bacteriological analyses during the summer months.

Snails present in some areas of the lake were found to harbour the tiny parasite which is responsible for swimmers' itch. Should the cottagers decide that chemical control of snails is essential to combat the problem, a survey will be necessary to delineate the areas which require treatment. Because of the potential hazard to fish and fish food organisms, it will be necessary that approval be secured from the Ontario Department of Lands and Forests and that a permit be issued by the Ontario Water Resources Commission prior to any chemical application.

Introduction

Complaints were received by the Ontario Water Resources Commission in 1965 and 1966 from cottagers on Rankin Lake concerning an alleged deterioration of the lake. The reports indicated that discharge from a sewage lagoon at Camp Wakana was polluting the lake. Other reports indicated that bathers were suffering from a skin irritation.

A biological survey of Rankin Lake was undertaken in May and September, 1967, to assess the effects of the lagoon discharge on the lake and to ascertain the cause of the skin irritations.

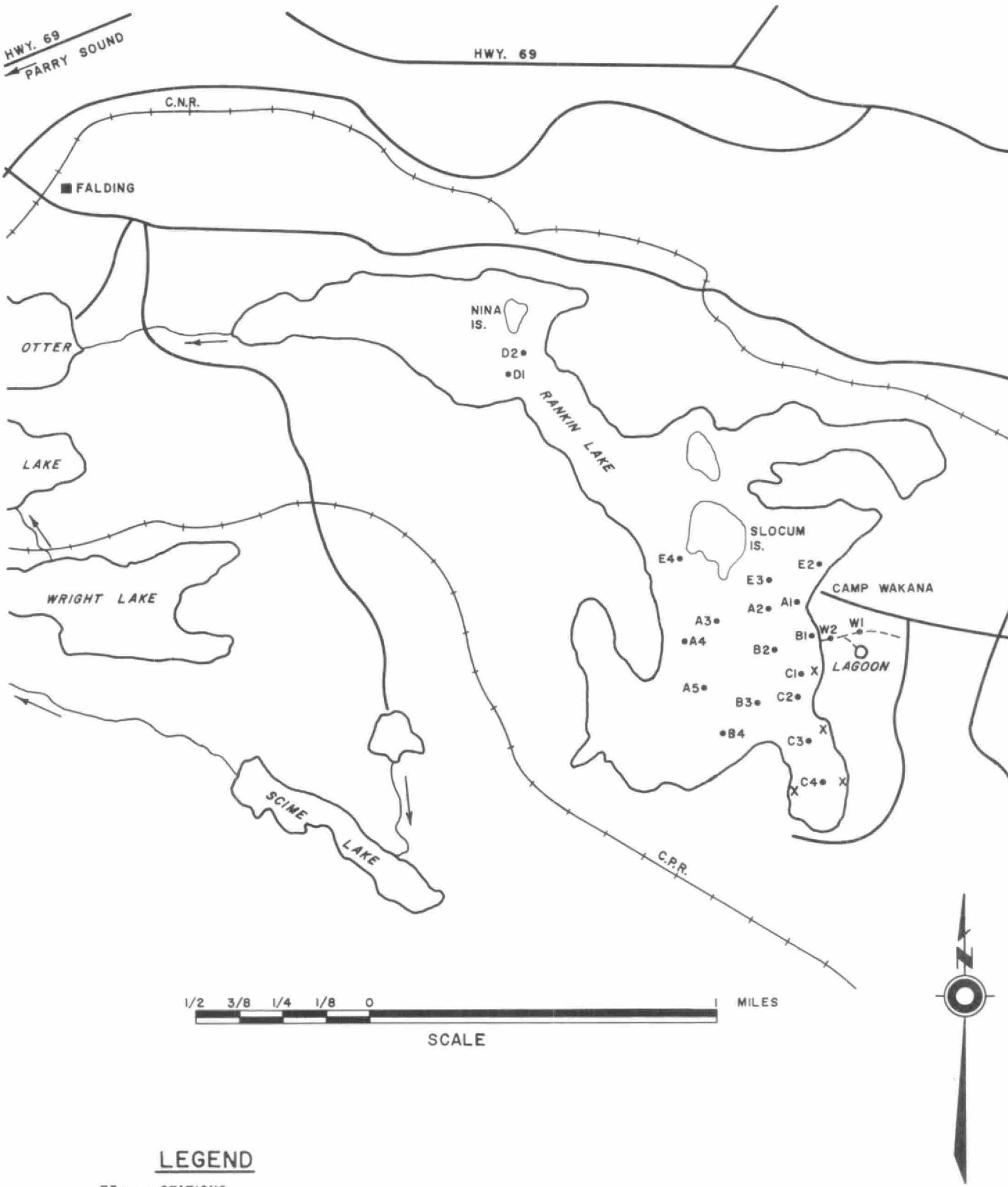
Description of the Study Area

Rankin Lake is in Foley Township in the District of Parry Sound, (lat. 45° 15' north; long. 79° 54' west). Much of the shoreline is occupied by cottages. While the lake supports a good largemouth bass population, there seems to be little value placed on the fishery by the cottagers.

Figure 1 shows the general features of the Rankin Lake area. Out-flow from the lake enters Otter Lake and thence flows indirectly to Georgian Bay via the Boyne River.

Camp Wakana lies on the southeast shore of the lake. The lagoon is located on the southern boundary of the Camp Wakana property. The contents of the lagoon are usually drawn down in November and April and the lagoon effluent enters Rankin Lake via a small creek which flows through the property.

FIG. I - MAP OF RANKIN LAKE AND VICINITY SHOWING SAMPLING STATIONS



LEGEND

E3• — STATIONS

X — INFECTED SNAIL BEDS

Interpretation of Biological Data

In a biological survey, emphasis is placed on the abundance and distribution of aquatic insects and other invertebrate life (macroinvertebrates) which frequent the bottom of the lake or river under study. Since some organisms are adapted to living only in 'clean water', while others are 'pollution-tolerant', a study of the aquatic communities provides a reliable assessment of water quality. A reduction of the number of major groups (taxa) and a substantial increase in the number of pollution-tolerant individuals, are indicative of organic pollution. Biological sampling has the advantage of reflecting the quality of the water over a considerable period of time prior to the survey. The data collected are supported by chemical and physical analyses of water which provide an instantaneous measure of water quality.

Methods

Data presented in this report were obtained in May and September, 1967. Seventeen stations were selected on Rankin Lake to collect macroinvertebrates from the bottom sediments (see Figure 1). A Petersen dredge was used to collect a sample of bottom equal to 96 square inches. Samples were screened through a 30-mesh per inch box screen. The macroinvertebrates retained by the screen were removed and preserved in 95% ethanol for later identification.

Macroinvertebrates were collected from two stations on the stream which receives the effluent from the lagoon. Using hand sieves, fifteen minutes of uniform effort were employed

to sample common habitats at these stations. Again the organisms collected were preserved in 95% ethanol for later identification.

Some snails collected from the bottom samples obtained during May were crushed between two microscope slides and examined under 60X magnification for the swimmers' itch parasite. In September, a Needham scraper was used to collect snails. This sampler is a flat spade-like instrument of wire mesh with a long handle, to sample the bottom and submergent vegetation in shallow water. To collect a sample of snails, the boat was moored close to shore and the Needham scraper was dragged along the bottom parallel to the boat.

The snails collected were placed in jars of cold water and were examined as soon as possible. Some were crushed and examined on a microscope slide under 60X magnification. Others were placed in vials of warm water and positioned below a source of strong illumination. Any swarming life forms discovered in the vials were captured with an eye-dropper and examined under 60X illumination.

Two 40-ounce samples of water were collected from each of stations B1 and A5 at two-week intervals by staff members of Camp Wakana. One sample was preserved with Lugol's iodine and forwarded to the Biology Branch of the Commission for algae identification and enumeration. The other was sent to the Chemistry Branch for chemical and physical analyses. In October, a sample from the lagoon was submitted for analyses, including the 5-day biochemical oxygen demand (BOD).

Results

Bottom Fauna

The macroinvertebrate bottom fauna community established by 24 dredgings representing 17 stations on Rankin Lake is shown in Table 1 of the Appendix.

The bottom fauna community was dominated by midge larvae (Chironomidae) at most stations. The amphipod, *Hyalella azteca* was abundant, also. Worms were represented by three genera of Tubificidae and one genus of the family Lumbriculidae. The planktonic true fly larvae, *Chaoborus* sp., were present at most stations.

Lesser numbers of immature mayflies, caddisflies, dragonflies, fishflies and snails, clams and leeches were collected, especially at the inshore stations.

The only relationship between the variation in numbers and distribution of organisms in Rankin Lake was found to be that normally expected with variations in depth and bottom types. The bottom fauna collected in the proximity of the discharge from the lagoon was not indicative of polluted water. The bottom fauna of Rankin Lake were very similar to the fauna collected during a biological survey of Otter Lake in 1966, (German, 1967).

The invertebrates collected from the stream which flows through the Camp Wakana property are

indicated in Table 2 of the Appendix. Although the lagoon had been drawn down a short time before the survey was conducted, no evidence of an effect on the biota was found. At W1, above the source of waste discharge, nine taxa and 31 individuals were collected. At W2, below the confluence of the effluent discharge and the small watercourse, eight taxa and 34 individuals were collected with the same effort. 'Clean water' taxa such as stoneflies, mayflies and caddisflies were found at both locations.

The chemical and physical analyses of water are shown in Table 3 of the Appendix. Since domestic sewage is high in phosphates and nitrates, one would expect that samples collected from the vicinity of the lagoon discharge during the fall would be high in these two parameters. Relatively high maxima were present in the fall before the lagoon was emptied. However, the quality of water within the lagoon in October was well within the objectives of the Commission for discharge to a watercourse.

Swimmers' Itch

The snails collected in May, 1967, did not show any infection with the parasite which causes swimmers' itch. The snails collected in September did show infection, particularly Gyraulus parvus. The areas where infected snails were found is shown in Figure 1. A brief description of the life history of the swimmers' itch parasite is included in the Appendix, as well as the methods used to control the snails which are the intermediate hosts.

References

German, M. J. 1967. Biological survey of Otter Lake (Northern Portion) Ontario Water Resources Commission Report.

Mackenthun, K. M. and W. M. Ingram. 1964. Limnological aspects of recreational lakes. U. S. Department of Health, Education, and Welfare. Public Health Service.

APPENDIX

SUMMARY OF ANALYTICAL DATA
AND DESCRIPTION AND CONTROL
OF SWIMMERS' ITCH.

Table 1. Specimens collected at 24 stations on Rankin Lake, May, 1967.

Taxa	A1a	A1b	A2	A3	A4	B1a	B1b	B2a	B2b	B3a	B3b	B4a
NEMATODES		2					2					
WORMS												
Peloscolex benedeni				3								
Limnodrilus		3		41	32		5			3		
Tubifex templetoni			2			2	2		2			
Eclipidrilus	2	2				5		2				
LEECHES												
Placobdella							2					
AMPHIPODS												
Hyalella azteca	92	54				62	80	77	71	3		2
MAYFLIES												
Hexagenia												
Ephemerella							3					
Choroterpes												
Ephemera		2				2	3	3				
Stenonema	8											
DRAGONFLIES												
Ophiogomphus						2	3					
FISHFLIES												
Sialis		2					2	3				2
CADDISFLIES												
Cyrnellus												
Lype	9	11				2		3				
Polycentropus	5	2						3				
Pupae						2						
TRUE FLIES												
Chaoborus			2	27	27							
Culicoides	6	5				9	9	3				
Dixa							3					
Chironomidae)	134	77	6	2		69	65	23	20	2	2	5
pupae)	2	2				3	2	8	2			
MITES	3							3			2	
SNAILS												
Planorbidae	2	2										
CLAMS												
Sphaeriidae		5				6	3	11	2			
No. of Taxa	9	12	3	4	2	11	13	11	4	3	2	3
No. Individuals	263	169	10	73	59	164	184	141	97	8	4	9

Table 1. continued

Taxa	B4b	C1a	C1b	C2	C3a	C3b	C4	E2	E3	E4	D1	D2
NEMATODES		2										
WORMS												
Peloscolex benedéni												
Limnodrilus									14			2
Tubifex templetoni				5		2		2		2	2	3
Eclipidrilus			2	9						8		6
LEECHES												
Placobdella												
AMPHIPODS												
Hyalella azteca	6	41	27	69				9		23	2	14
MAYFLIES												
Hexagenia	5						3					3
Ephemerella												
Choroterpes				3								
Ephemera			2	3						3		
Stenonema												
DRAGONFLIES												
Ophiogomphus												
FISHFLIES												
Sialis				2	2							
CADDISFLIES												
Cyrnellus												
Lype		2	3					3				
Polycentropus						2	2					
pupae												
TRUE FLIES												
Chaoborus					3				11		2	
Culicoides	3	2	9	3				3	2		12	
Dixa												
Chironomidae)	18	30	29	63	5	5	5	99	5	129	8	
pupae)				2	2		2				2	
MITES			2	2	2			2				
SNAILS												
Planorbidae				2								
CLAMS												
Sphaeriidae		2			2							
No. of Taxa	3	6	7	10	6	3	3	6	4	6	4	7
No. Individuals	29	80	67	169	19	9	12	118	32	177	16	28

Table 2. Specimens collected at two stations on a small stream entering Rankin Lake at Camp Wakana*

W1 is above the lagoon discharge
W2 is below the lagoon discharge

TAXA	W1	W2
AMPHIPODS		
Hyalella azteca	7	5
CRAYFISH		
Cambarus diogenes	4	
MAYFLIES		
Hexagenia	2	
Ephemerella	1	
Choroterpes		6
STONEFLIES		
Nemoura		2
CADDISFLIES		
Polycentropus	1	
Neophylax	2	
Goera		2
TRUE FLIES		
Tipulidae	3	
Prosimulium	6	
Twinnia tibbles	5	3
Chironomidae		4
SNAILS		
Aplexa hypnorum		3
CLAMS		
Sphaeriidae		9
Number of Taxa	9	8
Number of Individuals	31	34

* fifteen minute collections with a hand sieve from both areas.

Table 3. Chemical analyses of Rankin Lake and lagoon water, May - October, 1967.

	STATION B1			STATION A5			LAGOON
	Min.	Mean	Max.	Min.	Mean	Max.	Oct. 5
Total PO_4							
Phosphorus	0.01	0.41	1.50	0.01	0.03	0.05	6.30
Nitrate	0.04	0.45	2.50	0.04	1.60	5.00	10.0
Total solids		34.0			44.0		224.
Susp. solids		2			1		99
Hardness	16	17	18	16	16	18	
Alkalinity	8	9.2	10	8	9.4	10	
Acidity	2.0	2.7	4.2	2.0	3.0	4.2	
Lab pH	6.7	7.9	8.9	6.9	7.6	8.1	
5 day BOD							4.0

All results expressed in parts per million except pH.

LIFE HISTORY AND CONTROL OF THE SWIMMERS' ITCH PARASITE

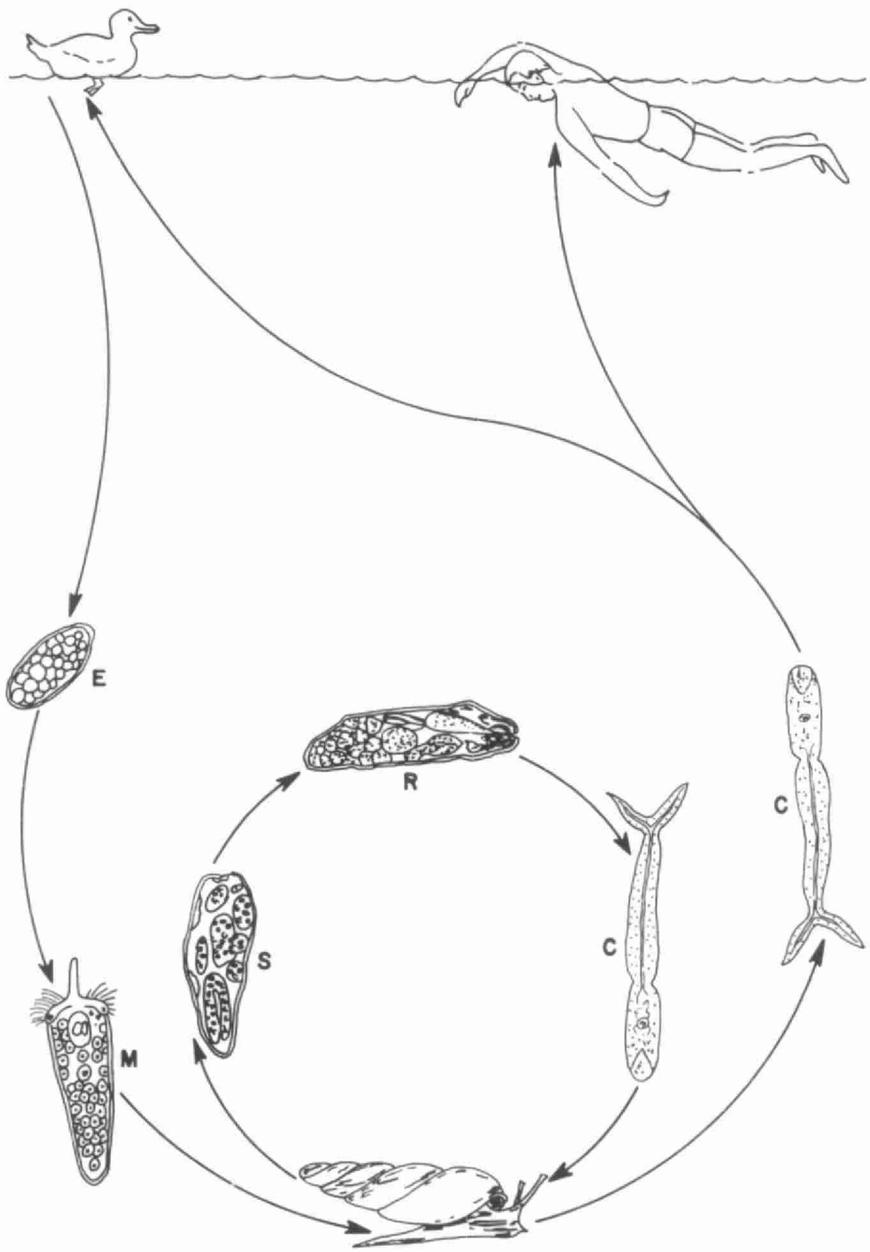
Swimmers' itch is a water rash which affects bathers at certain times of the summer. It is only found in waters which are inhabited by certain species of snails. Not all waters inhabited by snails will carry the parasite.

Figure 1 shows the life cycle of the parasite. The stage which infects bathers is the cercaria. It is a free-swimming, translucent organism barely visible to the naked eye.

The adult trematode (fluke) is an internal parasite of birds, particularly waterfowl, and some mammals. Eggs are passed from the definitive host, (bird), in the feces and develop into free swimming miracidia. If a suitable snail is found the miracidium penetrates into the soft tissues and develops and reproduces into cercariae. The cercariae emerge from the snail as the free-swimming stage capable of infecting bathers. Human infection with the parasite is accidental. Normally, the cercariae enter the proper definitive host, (birds and mammals), and the life cycle is completed. If the parasite enters the human body by burrowing under the skin, it soon dies. The body reacts to the 'foreign material' and the bather experiences a tingling sensation in the region of the infection, followed by the appearance of red eruptions on the skin.

The varying sensitivity of individuals accounts for the difference in the degree of discomfort. Some bathers experience considerable pain, fever and severe itching; others appear to be immune.

FIGURE I - LIFE CYCLE OF SWIMMER'S ITCH



LEGEND

E — EGG

M — MIRACIDIUM

S — SPOROCYST

R — REDIA

C — CERCARIAE

FROM: LIMNOLOGICAL ASPECTS OF RECREATION LAKES, 1964: PAGE 108.
U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE.

The skin eruptions usually disappear within a week but the redness may persist for some time.

The infection is essentially a sensitization reaction. The first exposure produces only a mild response, but subsequent exposures produce more severe symptoms.

Control

Individual bathers can protect themselves, after emerging from the water, by rubbing the body with a rough towel before the water droplets evaporate. A shower taken immediately after leaving the water is also effective in reducing the severity of the rash.

The practice of alternately swimming and sunbathing provides an excellent opportunity for severe infection.

Chemical control is aimed at the parasite's alternate host, the snail. If the snails are eliminated, the life cycle of the parasite is interrupted and the problem will disappear.

Established control measures in shallow water may be toxic to young fish and aquatic invertebrates which are important as fish food. Copper sulphate has been the molluscicide most widely used to reduce snail populations. It is usually applied at a rate of three pounds of copper sulphate per 1000 square feet. However, it has been established that only a proportion of the snails are killed with this chemical. A new compound, known as Bayluscide, appears to be much more effective

and experimental evaluations of this chemical by the OWRC are currently underway elsewhere in Ontario.

If the infected areas are small in relation to the size of the lake, treatment with copper sulphate may not significantly affect the fisheries potential.